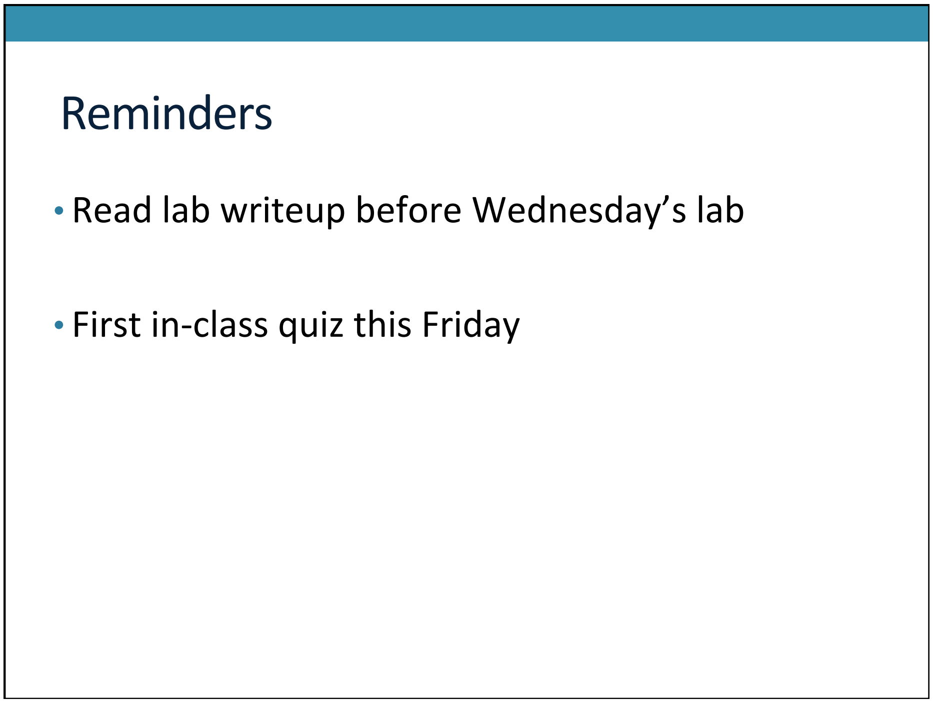
LECTURE 3: ARRAYLIST & STANDARD JAVA GRAPHICS

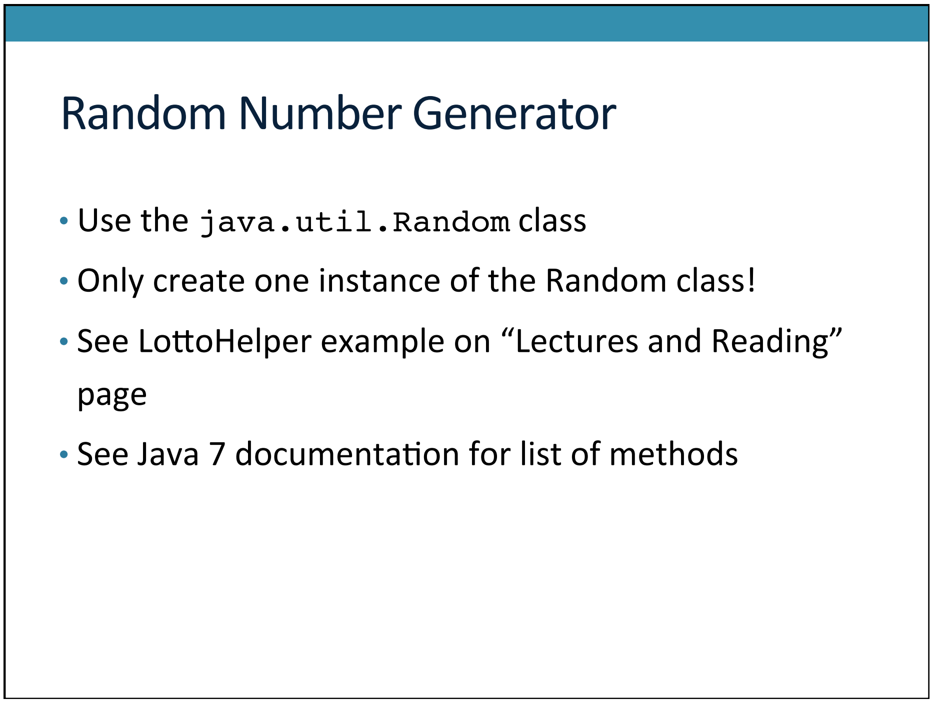
Today

- Reading
  - Java Graphics (on lectures page)
  - GUIs and assertions (on handouts page)
- Objectives
  - Useful classes for this week's assignment
  - arrays and ArrayList
  - Java Graphics



Reminders

- Read lab writeup before Wednesday’s lab
- First in-class quiz this Friday



Random Number Generator

- Use the `java.util.Random` class
- Only create one instance of the Random class!
- See LottoHelper example on “Lectures and Reading” page
- See Java 7 documentation for list of methods

Text Input

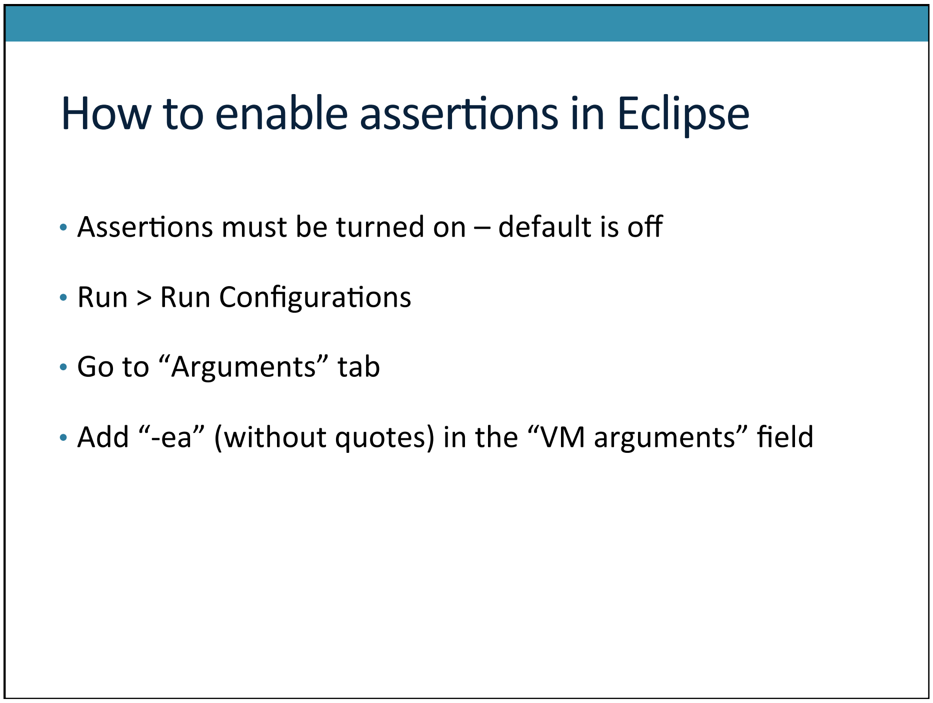
- Use java.util.Scanner to read from the command line
  - Constructor: myScanner = new Scanner(System.in)
- To read:
  - myScanner.nextInt() – returns an int
  - myScanner.nextDouble() – returns a double
  - myScanner.nextLine() – returns String to end of line

Assertions

- An assertion is a statement that tests an assumption about your program
- Use the Java `assert` keyword

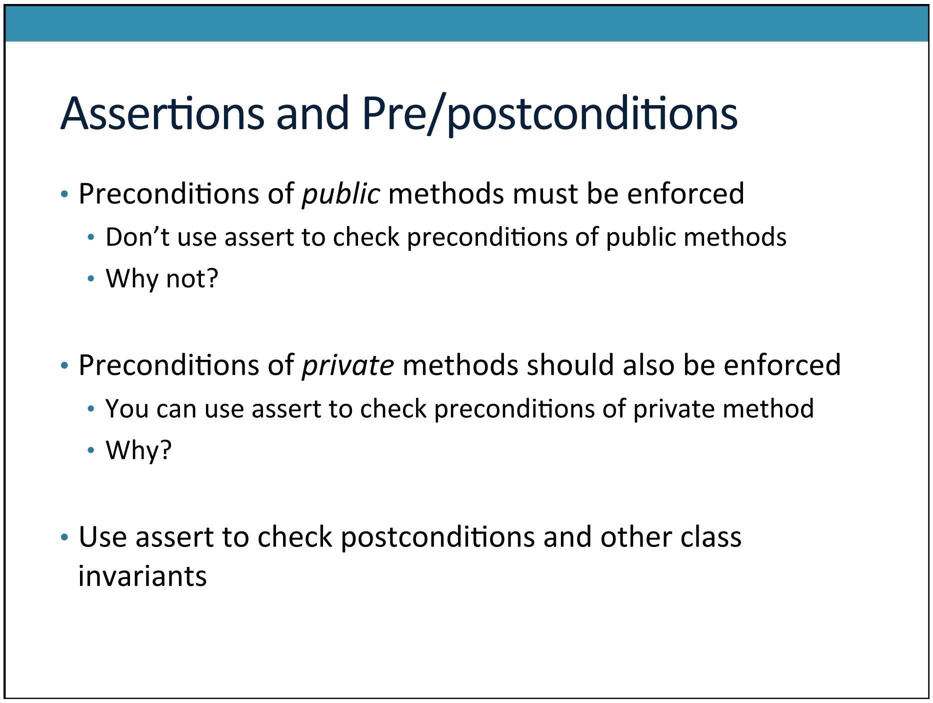
```
assert boolExp;
assert boolExp : message;
```

- If assertion is false, an AssertionException is thrown
- See Ratio example from Lecture 2



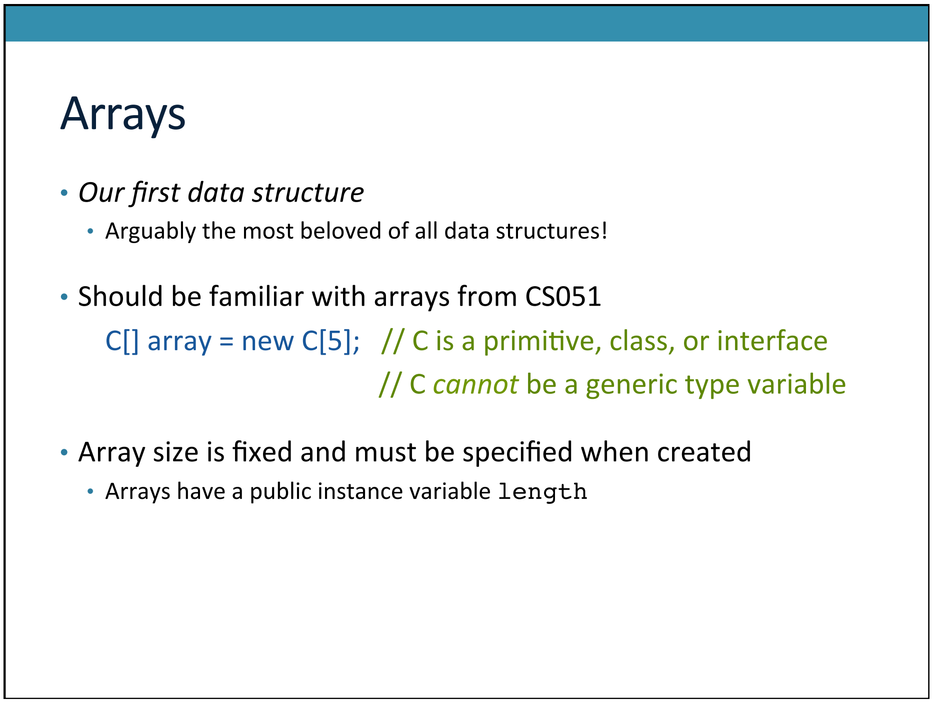
How to enable assertions in Eclipse

- Assertions must be turned on – default is off
- Run > Run Configurations
- Go to “Arguments” tab
- Add “-ea” (without quotes) in the “VM arguments” field



Assertions and Pre/postconditions

- Preconditions of *public* methods must be enforced
  - Don’t use assert to check preconditions of public methods
  - Why not?
- Preconditions of *private* methods should also be enforced
  - You can use assert to check preconditions of private method
  - Why?
- Use assert to check postconditions and other class invariants

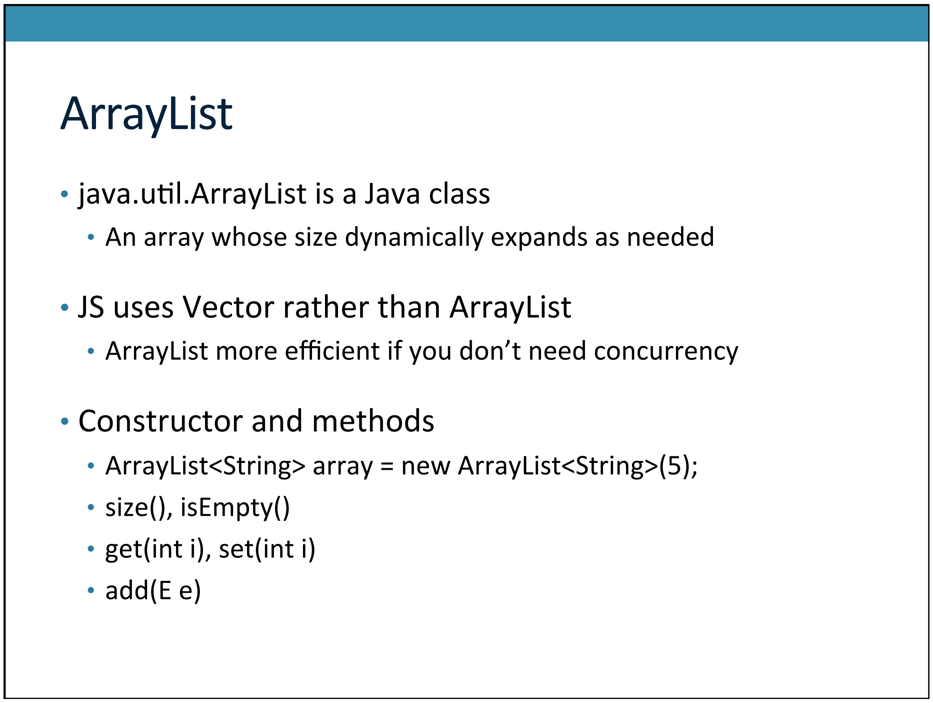


Arrays

- *Our first data structure*
  - Arguably the most beloved of all data structures!
- Should be familiar with arrays from CS051

```
C[] array = new C[5];   // C is a primitive, class, or interface
                        // C cannot be a generic type variable
```

- Array size is fixed and must be specified when created
  - Arrays have a public instance variable `length`



ArrayList

- java.util.ArrayList is a Java class
  - An array whose size dynamically expands as needed
- JS uses Vector rather than ArrayList
  - ArrayList more efficient if you don't need concurrency
- Constructor and methods
  - ArrayList<String> array = new ArrayList<String>(5);
  - size(), isEmpty()
  - get(int i), set(int i)
  - add(E e)

Java Graphics

- Graphical User Interfaces (GUIs)
  - JFrame: the window
  - JPanel: used for layout management
  - JButton, JTextField, JSlider, Jchooser, etc.
- Events
  - Implement MouseListener, ActionListener, ChangeListener
- Graphics
  - May be familiar with DrawingCanvas from objectdraw library
  - Focus of today's lecture

Java Graphics

- First, create the geometric objects you want to draw
  - java.awt.geom.Rectangle2D.Double, Line2D.Double
  - Constructors take x, y, width, height but don't actually draw the object
- Drawing happens in the paint method of the component class (i.e. JFrame)

```
public void paint(Graphics g) // inside JFrame class
```

- Think of paint is a "pen" drawing on the screen

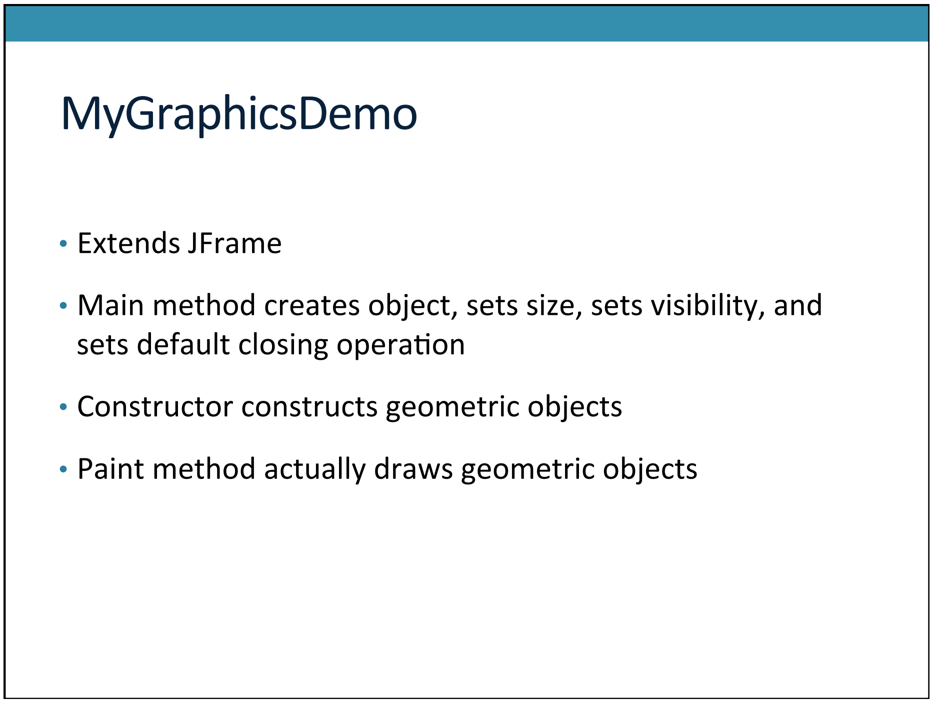
The paint method

public void paint(Graphics g)

- g is a Graphics context
- Need to cast it to a Graphics2D object
- g2.draw(myObj) – draws the outline only
- g2.fill(myObj) – draws filled version
- g2.drawString(“this is a string”, x, y) – draws a string
- myObj.setFrame(x,y,width,height) can move object

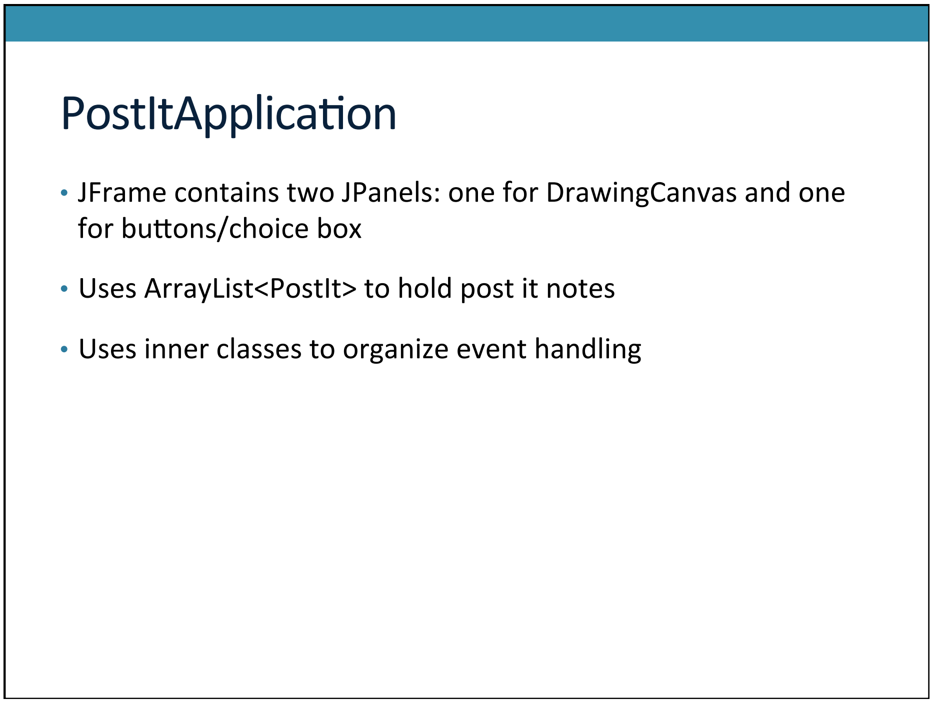
When creating a graphics application,

- *You should never call paint(), call repaint() instead*
- Create an extension of a component (JPanel, JFrame, JApplet)
  - See main method of demo to get window to show
- Inside this class, implement the paint method
  - Recast Graphics to Graphics2D
- Call repaint() on component every time make a change
  - Causes OS to schedule call of paint in event queue
  - Called automatically if window obscured and revealed



MyGraphicsDemo

- Extends JFrame
- Main method creates object, sets size, sets visibility, and sets default closing operation
- Constructor constructs geometric objects
- Paint method actually draws geometric objects



PostItApplication

- JFrame contains two JPanels: one for DrawingCanvas and one for buttons/choice box
- Uses ArrayList<PostIt> to hold post it notes
- Uses inner classes to organize event handling

EXTRA SLIDES